
EFFECT OF THE INVENTION

[Effect of the Invention]
Since this invention protrudes a drive child on the base which a piezoelectric device is joined and generates crookedness vibration and stretching vibration in coincidence at one and it was made to make the coupling oscillation of the predetermined direction cause at the tip of a drive child so that clearly from the above explanation, the following effectiveness is acquired.
(b) small and a thin form — lightweight — it can design — manufacture — it is easy and cheap.
(b) Since a dimension etc. can therefore be chosen as a service condition at arbitration, an elastic design is possible.
(c) Driver voltage is low and a power source is easy.
(d) Since the slider is always carrying out the pressure welding to the drive child, there is no backlash and **** and ****** are made.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]
The trouble that fabrication operation is complicated, and an ultra-thin thing is not got by not only a base but the drive child by the above conventional piezo-electric resonance motors since a drive child's die length (height) needs to some extent since predetermined actuation is not obtained unless it carries out junction arrangement of the piezoelectric device so that a polarity may agree in a specification of operation is ******.
It was made in order to cancel this trouble, the junction part of a piezoelectric device is lessened, and this invention simplifies fabrication operation, it is a thin form and aims at obtaining the piezo-electric resonance motor of low cost.

[Translation done.]

MEANS

[Means for Solving the Problem]
The piezo-electric resonance motor concerning this invention is equipped with the resonance unit which consists of a square bar-like base, two or more piezoelectric devices which junction arrangement is carried out [piezoelectric devices] in the predetermined location of this base, and therefore make coincidence cause [an alternation electrical signal] crookedness vibration and longitudinal telescopic motion of a higher harmonic to a base, and at least two drive children who protruded towards the above-mentioned crookedness vibration at a base and one.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
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EXAMPLE

[Example]
Figs. 1 - 5 show one example of this invention, and piezoelectric-device 2a of the piezo-electric effect d31, 2b, and 2c are stuck on the inferior surface of tongue of the base 1 which becomes with a square bar-like elastic body in Fig. 1 and Fig. 2 . The drive children 3a and 3b projected and formed in the top face of a base 1 at one are located in the center of an abdomen at the time of crookedness resonance actuation of a base 1, and form the resonance unit U1.
the elastic body which unified a base 1 and the drive children 3a and 3b — oscillating loss, such as glassy carbon material and a fiber reinforced metal FRM, — being few — abrasion resistance — rich — and a coefficient of thermal expansion — a piezoelectric device -- the same — the small ingredient is suitable for about 2.5x10-6/degree C.
Fig. 3 shows the higher-harmonic (3rd overtone) resonance style of the resonance unit U1 shown in Fig. 1 and Fig. 2 , and the knot section is formed in five places and it forms four abdomens in a1, a2, b1, and b2 — having — making — a core unsymmetrical form — intermediary ****. The drive children 3a and 3b are formed in the location of the abdomens a1 and a2 outside a core, respectively.
First, if the actuation of the resonance unit U1 which becomes the above configuration is seen in a detail, if an alternation signal is mutually impressed to piezoelectric devices 2a and 2c from Terminals 4a and 4c at juxtaposition, by piezoelectric-device 2a, crookedness vibration of a higher harmonic (the 3rd overtone) will be caused to a lifting and coincidence, therefore, it will cause longitudinal direction fundamental-tone resonance of a square bar-like elastic body to piezoelectric-device 2c, and the resonance unit U1 will perform a coupling oscillation.
The knot of vibration generated on the fundamental-tone frequency of the die-length direction appears in one point of a core, and the both ends of a square bar become displacement max, respectively.
Since the drive children's 3a and 3b location is located now in the location of the antinode of the both-ends approach of a base 1, while the behavior on the drive children's 3a and 3b top face of a tip moves up and down by turns, it will vibrate also to the longitudinal direction of a base 1 [it]. Therefore, if the pressure welding of the slider 5 is carried out at the drive children's 3a and 3b tip with the koro 6, such as a ball bearing made from plastics, and the spring means 7 for bias as shown in Fig. 4 , a slider 5 will be moved in the direction of a continuous-line arrow head by friction of both contact part by polarization arrangement of Fig. 1 . Moreover, in the parallel feed to piezoelectric-device 2c and 2b, a slider 5 moves in the direction of a broken-line arrow head. Thus, by switching electrical-potential-difference impression, the migration direction of a slider 5 is controllable to arbitration.
Moreover, coating of an isobutylene-isoprene-rubber system is performed to a contact surface side with the drive child of a slider 5, and migration of a slider 5 is made smooth. If the admixture of for example, an isobutylene-isoprene-rubber system is applied to the drive children's 3a and 3b point when moving an ATM card etc. instead of a slider 5, slip actuation will decrease. According to the ingredient of a card, even if it has this spreading material, it should just choose what has good effectiveness.
Fig. 5 shows the case where carry out the pressure welding of the endless belt 8 to the drive children 3a and 3b of the resonance unit U1, and the roll control of the endless belt 8 is carried out in the direction of arbitration.
In addition, in Fig. 1 and Fig. 2 , although the case where the drive children's 3a and 3b location was a location of the antinode of base 1 both ends was shown, in a drive child, it is good also as a location of the antinodes b1 and b2 of main approach in Fig. 3 , and the same effectiveness is acquired. In this case, the application of a heavy load drive is presented and it is more more effective than a rate.
Moreover, piezoelectric-device 2c in Fig. 1 may carry out junction arrangement on a base 1 on the inferior surface of tongue, separates the part, and it carries out a specification to self-oscillation as a feedback terminal. If a feedback signal is used for drawing from piezoelectric devices [2a and 2d] both and this is used for parallel connection, since mixing of signals other than the 3rd overtone can be prevented, it is effective for performing the stable oscillation.
Next, the example of a concrete numeric value of the above-mentioned example is given.
base: — quality-of-the-material [of a 6.0mm/ in die-length / of 107.8mm / x thickness / x width-of-face a base of 15.0mm]: -- hard aluminum drive child: — location [of a height / of 2.0mm / x width-of-face drive child of 3.5mm]: — base both ends — 20mm piezoelectric-device: — object for crookedness Object for 0.6mm die length in die-length [of 15mm] x width-of-face [of 12mm] x thickness thickness [of 0.6mm resonance unit U1 in die-length / of 30mm / x width-of-face / of 12mm / x thickness]: — 0.6+6+2= 8.6mm drive frequency: — 23.07kHz

input voltage: — 6V (r. m.s)
slider quality-of-the-material: -- phenol resin, isobutylene-isoprene-rubber containing 3mm thickness slider contact surface:binder, and 1mm Health and Welfare Minister pair-migration force:150g migration Speed: — a second, the experiment effectiveness of still a more more than [230mm /] is the case where a common ingredient is used, and if you examine an ingredient further by the purpose of use, naturally it will be expected that a ****** value is acquired more by the purpose.
Figs. 6 - 8 show other examples, while the resonance unit U2 sticks piezoelectric devices 11a and 11b on the inferior surface of tongue of the square bar-like base 9 and sticks piezoelectric-device 11c on the top face of a base 9 in the center section, it comes to protrude in the drive children 10a and 10b, and the drive children 10a and 10b are in the locations C1 and C2 of the antinode of vibration shown in Fig. 8 . 12 is an attaching hole and is in the location of the knot of vibration of both crookedness and die length.
A base 9 is a higher harmonic (the first overtone) about crookedness mode, and this example resonates die-length mode by fundamental tone, respectively.
If the electrical potential difference of resonance frequency is now impressed to piezoelectric devices 11a and 11c from Terminals 13a and 13c, the first overtone mode as shown in Fig. 8 will occur by piezoelectric-device 11a. Therefore, resonance in die-length mode is caused to coincidence at piezoelectric-device 11c, and a coupling oscillation occurs. Thereby, in the case of the direction of polarization shown in Fig. 6 , the slider (not shown) by which the pressure welding is carried out to the drive children 10a and 10b moves in the direction of a continuous-line arrow head. Similarly, if parallel feed is switched and carried out to piezoelectric devices 11b and 11c, a slider will move in the direction of a broken-line arrow head.

[Translation done.]

CORRECTION OR AMENDMENT

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[Application number] Japanese Patent Application No. 62-20443
[Patent number] 2137057
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[Procedure revision]
"Term of "Claim" 1 Base Which Becomes with 1 Square Bar-like Elastic Body, It consists of a resonance unit equipped with two or more drive children who protruded on the 1 side-face predetermined location of this base at one, and two or more piezoelectric devices which it is joined [piezoelectric devices] to said base, and an alternation electrical potential difference is applied [piezoelectric devices], and make said base generate crookedness resonance vibration of a higher harmonic, and the die-length direction resonance vibration in coincidence. Said drive child It is located in the oscillating direction side of the antinode Kaminaka center section at the time of crookedness resonance of said base. Piezo-electric resonance motor is equipped with the means for switching of the electrical potential difference which applies a polarization polarity to the piezoelectric device which carried out the selected array, carries out phase adjustment of a part of piezoelectric device and the signal from either of the feedback terminals established separately, and forms a self-excitation circuit, and it was made to impress a trigger electrical potential difference from a feedback terminal for a stable drive. It amends as ".
2 The term of "explanation of the detail of invention" "this invention relates to a piezo-electric resonance motor with the easy point-to-point control of a highly precise straight-line drive by the small light weight especially about a piezo-electric resonance motor.
Fig. 9 and Fig. 10 are this kind of the former (application for utility model registration No. 161013 [Showa 61 to]) for which these people applied previously of piezo-electric resonance motors, and become with an elastic body in drawing, and two drive children 22a and 22b protrude on one side face of the square bar-like base 21. The drive children 22a and 22b correspond to the location of the antinode of vibration of a base 21. The 2nd piezoelectric device 24 is stuck on each side of the drive children 22a and 22b for two piezoelectric devices 23a and 23b for crookedness modes at the base 21.
Thus, the constituted resonance unit U3 is suitably fixed by the attaching hole 25 formed in the location of a knot. ** ** is the polarity of polarization and A1, A2, B1, B-2, and B show the terminal of a connection lead, respectively.

if ** electrical potential difference of an ultrasonic range is looked like [Terminals A1 and B] and is supplied by the above configuration, a base 21 and the drive children 22a and 22b will be crooked like a dotted line, and the driven object (not shown) by which the pressure welding is carried out at the drive children's 22a and 22b tip will begin to be kicked by drive child 22a in the direction of a continuous-line arrow head.
If ** electrical potential difference is impressed to Terminals A1 and B, the resonance unit U3 will be crooked like a broken line, and drive child 22b will begin to kick a driven object in the direction of a continuous-line arrow head shortly.
If the above electrical-potential-difference impression is performed for Terminals A2 and B, since polarization by the side of a terminal A1 and A2 is mutually reverse, actuation will become reverse and a driven object will be driven in the direction of a broken-line arrow head.
The straight-line drive of the driven object is carried out in the direction opposed to two each other as mentioned above at arbitration.
By the above conventional piezo-electric resonance motors, since predetermined actuation was not got by not only a base but the drive child unless it carried out junction arrangement of the piezoelectric device so that a polarity

might agree in a specification of operation, fabrication operation was complicated, and since a drive child's die length (height) needed to some extent, there was a trouble that an ultra-thin thing was not obtained.
This invention was made in order to cancel this trouble, lessens the junction part of a piezoelectric device and carries out simple [of the fabrication operation], and it is a thin shape and aims at obtaining the piezo-electric resonance motor of low cost.
With the base which the configuration of this invention becomes with a square bar-like elastic body, and two or more drive children who protruded on the 1 side-face predetermined location of this base at one It consists of a resonance unit equipped with two or more piezoelectric devices which it is joined [piezoelectric devices] to said base, and an alternation electrical potential difference is applied [piezoelectric devices], and make said base generate crookedness resonance vibration of a higher harmonic, and the die-length direction resonance vibration in coincidence, and said drive child is located in the oscillating direction side of the antinode Kaminaka center section of ** at the time of crookedness resonance of said base. It has the means for switching of the electrical potential difference which applies a polarization polarity to the piezoelectric device which carried out the selected array, and phase adjustment of a part of piezoelectric device and the signal from either of the feedback terminals established separately is carried out, a self-excitation circuit is formed, and it is the piezo-electric resonance motor it was made to impress a trigger electrical potential difference from a feedback terminal because of a stable drive.
To the piezoelectric device which makes a base cause crookedness vibration in this invention when an operation is described in this invention, and the piezoelectric device which makes die-length resonance cause, if the alternation electrical signal of resonance frequency is impressed to juxtaposition, since a resonance unit will vibrate to coincidence and will carry out compound resonance in the mode in both crookedness mode and die-length mode, a drive child's free end vibrates in the predetermined direction.
Next, if an example 1 is described, Figs. 1 thru/or 5 show one example of this invention, and piezoelectric-device 2a of the piezo-electric effect d31, 2b, and 2c are stuck on the inferior surface of tongue of the base 1 which becomes with a square bar-like elastic body in Fig. 1 and Fig. 2. The drive children 3a and 3b projected and formed in the top face of a base 1 at one are located in the center of an abdomen at the time of crookedness resonance actuation of a base 1, and form the resonance unit U1.
the elastic body which unified a base 1 and the drive children 3a and 3b — oscillating loss, such as glassy carbon material and a fiber reinforced metal FRM, — being few — abrasion resistance — rich — and a coefficient of thermal expansion — a piezoelectric device — the same — the small ingredient fits 2.5x10-6/Celsius degree extent. Fig. 3 shows the higher-harmonic (3rd overtone) resonance style of the resonance unit U1 shown in Fig. 1 and Fig. 2, the knot section is formed in five places, and four abdomens are formed in a1, a2, b1, and b2, and it has a core unsymmetrical form. The drive children 3a and 3b are formed in the location of the abdomens a1 and a2 outside a core, respectively.
First, if the actuation of the resonance unit U1 which becomes the above configuration is seen in a detail, if an alternation signal is mutually impressed to piezoelectric devices 2a and 2c from Terminals 4a and 4c at juxtaposition, by piezoelectric-device 2a, crookedness vibration of a higher harmonic (the 3rd overtone) will be caused to a lifting and coincidence, therefore, it will cause longitudinal direction fundamental-tone resonance of a square bar-like elastic body to piezoelectric-device 2c, and the resonance unit U1 will perform a coupling oscillation.
The knot of vibration generated on the fundamental-tone frequency of the die-length direction appears in one point of a core, and the both ends of a square bar become displacement max, respectively.
Since the drive children's 3a and 3b location is located now in the location of the antinode of the both-ends approach of a base 1, while the behavior on the drive children's 3a and 3b top face of a tip moves up and down by turns, it will vibrate also to the longitudinal direction of a base 1 [it]. Therefore, if the pressure welding of the slider 5 is carried out at the drive children's 3a and 3b tip with the koro 6, such as a ball bearing made from plastics, and the spring means 7 for bias as shown in Fig. 4, a slider 5 will be moved in the direction of a continuous-line arrow head by friction of both contact part by polarization arrangement of Fig. 1. Moreover, in the parallel feed to piezoelectric-device 2c and 2b, a slider 5 moves in the direction of a broken-line arrow head. Thus, by switching electrical-potential-difference impression, the migration direction of a slider 5 is controllable to arbitration.
Moreover, coating of an isobutylene-isoprene-rubber system is performed to a contact surface side with the drive child of a slider 5, and migration of a slider 5 is made smooth. If the admixture of for example, an isobutylene-isoprene-rubber system is applied to the drive children's 3a and 3b point when moving an ATM card etc. instead of a slider 5, slip actuation will decrease. What is necessary is just to choose it as what has good effectiveness according to the ingredient of a card, even if it has this spreading material.
Fig. 5 shows the case where carry out the pressure welding of the endless belt 8 to the drive children 3a and 3b of the resonance unit U1, and the roll control of the endless belt 8 is carried out in the direction of arbitration.
In addition, in Fig. 1 and Fig. 2, although the case where the drive children's 3a and 3b location was a location of the antinode of the both ends of a base 1 was shown, in a drive child, it is good also as a location of the antinodes b1 and b2 of main approach in Fig. 3, and the same effectiveness is acquired. In this case, the application of a heavy load drive is presented and it is more more effective than a rate.
Moreover, piezoelectric-device 2c in Fig. 1 may carry out junction arrangement on a base 1 on the inferior surface of tongue, separates the part, and it carries out a specification to self-oscillation as a feedback terminal. It is effective for performing the oscillation stabilized since mixing of signals other than the 3rd overtone was prevented when the feedback signal was used for drawing from both piezoelectric-device 2a and 2b and this was used for parallel connection.

Next, the example of a concrete numeric value of the above-mentioned example is given.
Base: 6.0mm[in die-length / of 107.8mm / x thickness] x width of face of 15.0mm
The quality of the material of a base: Hard aluminum
Drive child: Height [of 2.0mm] x width of face of 3.5mm
A drive child's location: It is 20mm from base both ends.
Piezoelectric device: For crookedness 0.6mm in die-length [of 15mm] x width-of-face [of 12mm] x thickness
For die length 0.6mm in die-length [of 30mm] xx width-of-face [of 12mm] x thickness
Thickness of the resonance unit U1: 0.6+6+2=8.6mm
Drive frequency: 23.07kHz
Input voltage: 6v (r. m.s)
Slider quality of the material: 3mm thickness of phenol resin
Slider contact surface: Isobutylene-isoprene-rubber 1mm thickness containing a binder
Relative-movement force: 150g
Migration Speed : 230mm/second
In addition, the above experiment effectiveness is the case where a common ingredient is used, and if you examine an ingredient further by the purpose of use, naturally it will be expected that the value which suited the purpose more is acquired. Figs. 6 thru/or 8 show other examples, while the resonance unit U2 sticks piezoelectric devices 11a and 11b on the inferior surface of tongue of the square bar-like base 9 and sticks piezoelectric-device 11c on the top face of a base 9 in the center section, it comes to protrude in the drive children 10a and 10b, and the drive children 10a and 10b are in the locations C1 and C2 of the antinode of vibration shown in Fig. 8. 12 is an attaching hole and is in the location of the knot of vibration of both crookedness and die length.
A base 9 is a higher harmonic (the 1st overtone) about crookedness mode, and this example resonates die-length mode by fundamental tone, respectively.
If the electrical potential difference of resonance frequency is now impressed to piezoelectric devices 11a and 11c from Terminals 13a and 13c, the 1st overtone mode as shown in Fig. 8 will occur by piezoelectric-device 11a. By piezoelectric-device 11c, resonance in die-length mode is caused to coincidence, and a coupling oscillation occurs in it. Thereby, in the case of the direction of polarization shown in Fig. 6, the slider (not shown) by which the pressure welding is carried out to the drive children 10a and 10b moves in the direction of a continuous-line arrow head. If parallel feed is similarly switched and carried out to piezoelectric devices 11b and 11c, a slider will move in the direction of a broken-line arrow head.
Next, if effectiveness is described, since this invention protrudes a drive child on the base which a piezoelectric device is joined and generates crookedness vibration and stretching vibration in coincidence at one and it was made to make the coupling oscillation of the predetermined direction cause at the tip of a drive child so that clearly from the above explanation, the following effectiveness will be acquired.
(**) small and a thin form — lightweight — it can design — manufacture — it is easy and cheap.
(**) since a dimension etc. can be chosen as arbitration according to a service condition, an elastic design is possible — certain **
(**) Driver voltage is low and a power source is easy.
(**) Since the slider is always carrying out the pressure welding to the drive child, there is no backlash and **** and ****** are made. It amends as ".

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PRIOR ART

[Description of the Prior Art]
Fig. 9 and Fig. 10 are this conventional kind of piezo-electric resonance motors for which these people applied previously (application for utility model registration No. 161013 [Showa 61 to]), and become with an elastic body in drawing, and two drive children 22a and 22b protrude on one side face of the square bar-like base 21. The drive children 22a and 22b are in the location of the antinode of vibration of a base 21. The 2nd piezoelectric device 24 is stuck on each side of the drive children 22a and 22b for two piezoelectric devices 23a and 23b for crookedness modes at the base 21. Thus, the constituted resonance unit U3 is suitably fixed by the attaching hole 25 formed in the location of a knot. ** As for the polarity of polarization, A1, A2 and B1, B-2, and B, ** shows the terminal of a connection lead, respectively.
By the above configuration, if ** electrical potential difference of an ultrasonic range is supplied to Terminals A1 and B, a base 21 and the drive children 22a and 22b are crooked like the chain line, and the driven object (not shown) by which the pressure welding is carried out at the drive children's 22a and 22b tip begins to be kicked by drive child 22a in the direction of a continuous-line arrow head.
If ** electrical potential difference is impressed to Terminals A1 and B, the resonance unit U3 will be crooked like a broken line, and drive child 22b will begin to kick a driven object in the direction of a continuous-line arrow head shortly.
If the above electrical-potential-difference impression is performed for Terminals A2 and B, since polarization by the side of a terminal A1 and A2 is mutually reverse, actuation will become reverse and a driven object will be driven in the direction of a broken-line arrow head.
The straight-line drive of the driven object is carried out in the direction opposed to two each other as mentioned above at arbitration.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Industrial Application]
When this invention is said in more detail about a piezo-electric resonance motor, it is a small light weight and relates to a piezo-electric resonance motor with the easy point-to-point control of a highly precise straight-line drive.
[Description of the Prior Art]
Fig. 9 and Fig. 10 are this conventional kind of piezo-electric resonance motors for which these people applied previously (application for utility model registration No. 161013 [Showa 61 to]), and become with an elastic body in drawing, and two drive children 22a and 22b protrude on one side face of the square bar-like base 21. The drive children 22a and 22b are in the location of the antinode of vibration of a base 21. The 2nd piezoelectric device 24 is stuck on each side of the drive children 22a and 22b for two piezoelectric devices 23a and 23b for crookedness modes at the base 21. Thus, the constituted resonance unit U3 is suitably fixed by the attaching hole 25 formed in the location of a knot. ** As for the polarity of polarization, A1, A2 and B1, B-2, and B, ** shows the terminal of a connection lead, respectively.
By the above configuration, if ** electrical potential difference of an ultrasonic range is supplied to Terminals A1 and B, a base 21 and the drive children 22a and 22b are crooked like the chain line, and the driven object (not shown) by which the pressure welding is carried out at the drive children's 22a and 22b tip begins to be kicked by drive child 22a in the direction of a continuous-line arrow head.
If ** electrical potential difference is impressed to Terminals A1 and B, the resonance unit U3 will be crooked like a broken line, and drive child 22b will begin to kick a driven object in the direction of a continuous-line arrow head shortly.
If the above electrical-potential-difference impression is performed for Terminals A2 and B, since polarization by the side of a terminal A1 and A2 is mutually reverse, actuation will become reverse and a driven object will be driven in the direction of a broken-line arrow head.
The straight-line drive of the driven object is carried out in the direction opposed to two each other as mentioned above at arbitration.
[Problem(s) to be Solved by the Invention]
The trouble that fabrication operation is complicated, and an ultra-thin thing is not got by not only a base but the drive child by the above conventional piezo-electric resonance motors since a drive child's die length (height) needs to some extent since predetermined actuation is not obtained unless it carries out junction arrangement of the piezoelectric device so that a polarity may agree in a specification of operation is ******.
It was made in order to cancel this trouble, the junction part of a piezoelectric device is lessened, and this invention simplifies fabrication operation, it is a thin form and aims at obtaining the piezo-electric resonance motor of low cost.
[Means for Solving the Problem]
The piezo-electric resonance motor concerning this invention is equipped with the resonance unit which consists of a square bar-like base, two or more piezoelectric devices which junction arrangement is carried out [piezoelectric devices] in the predetermined location of this base, and therefore make coincidence cause [an alternation electrical signal] crookedness vibration and longitudinal telescopic motion of a higher harmonic to a base, and at least two drive children who protruded towards the above-mentioned crookedness vibration at a base and one.
[Function]
In this invention, to the piezoelectric device which makes a base cause crookedness vibration, and the piezoelectric device which makes die-length resonance cause, if the alternation electrical signal of resonance frequency is impressed to juxtaposition, since a resonance unit will vibrate to coincidence and will carry out compound resonance in the mode in both crookedness mode and die-length mode, a drive child's free end vibrates in the predetermined direction.
[Example]
Figs. 1 - 5 show one example of this invention, and piezoelectric-device 2a of the piezo-electric effect d31, 2b, and 2c are stuck on the inferior surface of tongue of the base 1 which becomes with a square bar-like elastic body in Fig. 1 and Fig. 2 . The drive children 3a and 3b projected and formed in the top face of a base 1 at one are located in the center of an abdomen at the time of crookedness resonance actuation of a base 1, and form the resonance unit U1.

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CLAIMS

[Claim(s)]
[Claim 1] The piezo-electric resonance motor which consists of a resonance unit equipped with the base which becomes with a square bar-like elastic body, two or more drive children who protruded on the 1 side-face predetermined location of this base at one, and two or more piezoelectric devices which it is joined [piezoelectric devices] to said base, and an alternation electrical potential difference is applied [piezoelectric devices], and make said base generate crookedness resonance vibration of a higher harmonic, and the die-length direction resonance vibration in coincidence.
[Claim 2] The piezo-electric resonance motor of an application for patent given in the 1st term of the range by which the drive child is located in the oscillating direction side of the antinode Kaminaka center section at the time of crookedness resonance of a base.
[Claim 3] The piezo-electric resonance motor of the application for patent equipped with the means for switching of the electrical potential difference which applies a polarization polarity to the piezoelectric device which carried out the selected array given in the 1st term of the range.
[Claim 4] The piezo-electric resonance motor of the application for patent which carried out phase adjustment of a part of piezoelectric device and the signal from either of the feedback terminals established separately, and formed the self-excitation circuit given in the 1st term of the range.

[Translation done.]

the elastic body which unified a base 1 and the drive children 3a and 3b — oscillating loss, such as glassy carbon material and a fiber reinforced metal FRM, — being few — abrasion resistance — rich — and a coefficient of thermal expansion — a piezoelectric device — the same — the small ingredient is suitable for about 2.5x10-6/degree C.

Fig. 3 shows the higher-harmonic (3rd overtone) resonance style of the resonance unit U1 shown in Fig. 1 and Fig. 2 , and the knot section is formed in five places and it forms four abdomens in a1, a2, b1, and b2 — having — making — a core unsymmetrical form — intermediary ****. The drive children 3a and 3b are formed in the location of the abdomens a1 and a2 outside a core, respectively.

First, if the actuation of the resonance unit U1 which becomes the above configuration is seen in a detail, if an alternation signal is mutually impressed to piezoelectric devices 2a and 2c from Terminals 4a and 4c at juxtaposition, by piezoelectric-device 2a, crookedness vibration of a higher harmonic (the 3rd overtone) will be caused to a lifting and coincidence, therefore, it will cause longitudinal direction fundamental-tone resonance of a square bar-like elastic body to piezoelectric-device 2c, and the resonance unit U1 will perform a coupling oscillation.

The knot of vibration generated on the fundamental-tone frequency of the die-length direction appears in one point of a core, and the both ends of a square bar become displacement max, respectively.

TECHNICAL FIELD

[Industrial Application]
When this invention is said in more detail about a piezo-electric resonance motor, it is a small light weight and relates to a piezo-electric resonance motor with the easy point-to-point control of a highly precise straight-line drive.

[Translation done.]

PATENT ABSTRACTS OF JAPAN

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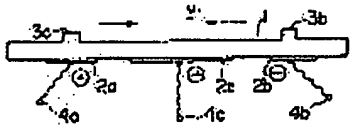
(21)Application number : 62-020443
(22)Date of filing : 02.02.1987

(71)Applicant : RION CO LTD
(72)Inventor : SUZUKI KAZUMA

(54) PIEZOELECTRIC RESONANCE MOTOR

(57)Abstract:
PURPOSE: To miniaturize and thin the title motor and reduce the weight of the same motor, by erecting integrally a driving piece on a base body, bonded with piezoelectric elements and generating bending vibration and contracting vibration simultaneously.
CONSTITUTION: Piezoelectric elements 2a～2c are bonded to the lower surface of a base body 1, consisting of a rectangular rod type elastic body, while driving pieces 3a, 3b are formed on the upper surface of the base body 1 so as to project therefrom. Said driving pieces 3a, 3b are located at the centers of loops upon the bending resonance oscillation of the base body 1 to form a resonance unit U1. When alternate electric signals, having a resonance frequency, are impressed on the piezoelectric elements 2a, 2c, which generate bending vibration in the base body 1, and the piezoelectric element 2c, which generates lengthwise resonance in the base body 1, in parallel, the resonance unit U1 vibrates simultaneously with the compound resonance of a bending mode and a lengthwise mode. As a result, the free ends of the driving pieces 3a, 3b may be vibrated into a predetermined direction.



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(56)参考文献　特開　昭63－154077（ＪＰ，Ａ）

(54)【発明の名称】　圧電共振モータ

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【特許請求の範囲】

【請求項１】角棒状の弾性体でなる基体と、この基体の一側面所定位置に一体に突設された複数個の駆動子と、前記基体に接合され交番電圧が加えられて前記基体に高調波の屈曲共振振動と長さ方向共振振動とを同時に発生させる複数個の圧電素子とを備えた共振ユニットからなる圧電共振モータ。

【請求項２】駆動子が、基体の屈曲共振時の腹上中央部の振動方向側に位置している特許請求の範囲第１項記載の圧電共振モータ。

【請求項３】分極極性を選択配列した圧電素子に加える電圧の切換手段を備えた特許請求の範囲第１項記載の圧電共振モータ。

【請求項４】圧電素子の一部および別個に設けたフイードバック端子のいずれかからの信号を位相調整して自励

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回路を形成した特許請求の範囲第１項記載の圧電共振モータ。

【発明の詳細な説明】

〔産業上の利用分野〕

この発明は、圧電共振モータに関するものであり、さらに詳しくいうと、小形軽量で、高精度な直線駆動の位置決め制御が容易な圧電共振モータに関するものである。

〔従来の技術〕

第９図，第10図は本出願人が先に出願した（実願昭61－161013号）、従来のこの種の圧電共振モータであり、図において、弾性体でなり、角棒状の基体21の一側面に、２つの駆動子22a，22bが突設されている。駆動子22a，22bは基体21の振動の腹の位置にある。基体21には屈曲モード用の２つの圧電素子23a，23bが、駆動子22a，22bの各面には第２の圧電素子24が貼着されている。このように構

成された共振ユニットU₃は、節の位置に形成された取付穴25により適宜に固定される。⊕，⊖は分極の極性、A_1，A_2，B_1，B_2およびBはそれぞれ接続リードの端子を示している。

以上の構成により、超音波領域の⊕電圧を端子A_1とBに供給すると、基体21と駆動子22a, 22bは鎖線のように屈曲し、駆動子22a, 22bの先端に圧接されている被駆動体（図示せず）は駆動子22aにより実線矢印の方向へ蹴り出される。

端子A_1とBに⊖電圧を印加すると、共振ユニットU₃は破線のように屈曲し、こんどは駆動子22bが被駆動体を実線矢印の方向へ蹴り出す。

以上の電圧印加を、端子A_2とBを対象にして行うと、端子A_1側とA_2側の分極が互いに逆であるため、動作が逆となり、被駆動体は破線矢印の方向へ駆動される。

以上のようにして被駆動体は、２つの互いに反対の方向へ任意に直線駆動される。

〔発明が解決しようとする問題点〕

以上のような従来の圧電共振モータでは、基体のみならず駆動子にも、動作仕様に極性が合致するように、圧電素子を接合配置しないと所定の動作が得られないことから、製造作業が複雑で、また、駆動子の長さ（高さ）がある程度必要とするために、極薄のものが得られないという問題点があつた。

この発明はかかる問題点を解消するためになされたもので、圧電素子の接合箇所を少なくして製造作業を簡略化し、薄形で、かつ、低コストの圧電共振モータを得ることを目的とする。

〔問題点を解決するための手段〕

この発明に係る圧電共振モータは、角棒状の基体と、この基体の所定位置に接合配置され交番電気信号によつて基体に高調波の屈曲振動および長手伸縮を同時に起こさせる複数個の圧電素子と、基体と一体に上記屈曲振動の方向に突設された少なくとも２つの駆動子とからなる共振ユニットを備えている。

〔作用〕

この発明においては、基体に屈曲振動を起こさせる圧電素子と長さ共振を起こさせる圧電素子とに、並列に共振周波数の交番電気信号を印加すると、共振ユニットは屈曲モードと長さモードの両方のモードで同時に振動して複合共振するので、駆動子の自由端は所定の方向に振動する。

〔実施例〕

第１図～第５図はこの発明の一実施例を示し、第１図，第２図において、角棒状の弾性体でなる基体１の下面に、圧電効果d_{31}の圧電素子2a, 2bおよび2cが貼着されている。基体１の上面に一体に突出形成された駆動子3a, 3bは、基体１の屈曲共振動作時の腹部中央に位置して共振ユニットU₁を形成している。

基体１と駆動子3a, 3bを一体化した弾性体は、ガラス状カーボン材や繊維強化金属FRMなど、振動損失が少なくて耐摩耗性に富み、かつ、熱膨張係数が圧電素子と同じ、2.5×10^{-6}／℃程度に小さい材料が適している。

第３図は、第１図，第２図に示す共振ユニットU₁の高調波（第３上音）共振姿態を示し、節部を５箇所に、腹部を４箇所a_1，a_2，b_1，b_2に形成されるようにし、中心非対称形になつている。駆動子3a, 3bはそれぞれ中心より外側の腹部a_1，a_2の位置に設けられている。

以上の構成になる共振ユニットU₁の動作を詳細にみると、まず、端子4a, 4cから圧電素子2a, 2cに交番信号を互いに並列に印加すると、共振ユニットU₁は、圧電素子2aにより高調波（第３上音）の屈曲振動を起こし、同時に圧電素子2cによつて角棒状弾性体の長手方向基音共振を起こして複合振動を行う。

長さ方向の基音周波数で発生した振動の節は中心部の一点にあらわれ、角棒の両端部はそれぞれ変位最大になる。

いま、駆動子3a, 3bの位置が基体１の両端部寄りの腹の位置にあるため、駆動子3a, 3bの先端上面の挙動は、交互に上下運動を行いながら、それと併行して基体１の長手方向にも振動することになる。そのため、第４図に示すように、スライダ５を、プラスチツク製のボールベアリングなどのコロ６およびバイアス用のバネ手段７により、駆動子3a, 3bの先端に圧接しておくと、両者の接触部分の摩擦により、スライダ５は、第１図の分極配置では、実線矢印の方向に移動される。また、圧電素子2cと2bへの並列給電では、スライダ５は破線矢印の方向へ移動する。このように電圧印加を切換えることにより、スライダ５の移動方向を任意に制御することができる。また、スライダ５の駆動子との接触面側にはブチルゴム系のコーテイングを施し、スライダ５の移動を円滑にしている。スライダ５の代りにキヤツシユカードなどを移動させるときは、駆動子3a, 3bの先端部に、たとえば、ブチルゴム系の混合材を塗布すると、スリツプ動作が少なくなる。この塗布材は、カードの材料に合わせて、もつとも効率のよいものを選択すればよい。

第５図は、共振ユニットU₁の駆動子3a, 3bにエンドレスベルト８を圧接してエンドレスベルト８を任意の方向に回転制御する場合を示している。

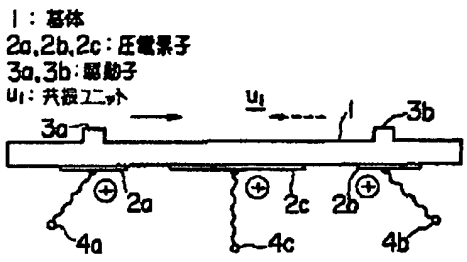
なお、第１図，第２図においては、駆動子3a, 3bの位置が基体１両端部の腹の位置である場合を示したが、駆動子を第３図で中心寄りの腹b_1，b_2の位置としてもよく、同様の効果が得られる。この場合は速度よりも高負荷駆動の用途に供して、より有効である。

また、第１図における圧電素子2cは基体１の上、下面に接合配置してもよく、その一部を切離してフイードバツク端子として自励発振用に仕様する。フイードバツク信号を圧電素子2a, 2dの両方から取出し、これを並列接続に使用すると、第３上音以外の信号の混入が防止できるので、安定した発振を行うのに効果的である。

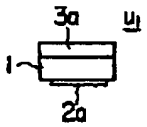
次に上記実施例の具体的数値例を挙げる。
基体：長さ107.8mm×厚さ6.0mm×幅15.0mm
基体の材質：硬質アルミニウム
駆動子：高さ2.0mm×幅3.5mm
駆動子の位置：基体両端より20mm
圧電素子：屈曲用　長さ15mm×幅12mm×厚さ0.6mm
長さ用　長さ30mm×幅12mm×厚さ0.6mm
共振ユニットU₁の厚さ:0.6＋6＋2＝8.6mm
駆動周波数:23.07kHz
入力電圧:6V (r.m.s)
スライダ材質：フエノール樹脂、3mm厚
スライダ接触面：バインダ入りブチルゴム、1mm厚
相対的移動力:150グラム
移動スピード:230mm/秒
なお、以上の実験効果は一般材料を用いた場合であり、使用目的により材料をさらに吟味すれば、より目的に合つた値が得られることは当然予想される。
第6図～第8図は他の実施例を示し、共振ユニットU₂は、角棒状の基体9の下面に圧電素子11a, 11bを貼着し、基体9の上面には中央部に圧電素子11cを貼着するとともに駆動子10a, 10bを突設してなるもので、駆動子10a, 10bは第8図に示す振動の腹の位置C₁, C₂にある。12は取付穴で、屈曲と長さ双方の振動の節の位置にある。この実施例は、基体9は屈曲モードを高調波（第一上音）で、長さモードを基音でそれぞれ共振するものである。
いま、端子13a, 13cから圧電素子11a, 11cに共振周波数の電圧を印加すると、圧電素子11aにより、第8図に示すような、第一上音モードが発生する。同時に圧電素子11＊

＊cによつて長さモードの共振を起こして複合振動が発生する。これにより、第6図に示す分極方向の場合、駆動子10a, 10bに圧接されているスライダ（図示せず）は、実線矢印の方向へ移動する。同様にして、圧電素子11b, 11cに切換えて並列給電すれば、スライダは破線矢印の方向へ移動する。
〔発明の効果〕
この発明は、以上の説明から明らかなように、圧電素子が接合されて屈曲振動、伸縮振動を同時に発生する基体に駆動子を一体に突設し、駆動子先端に所定方向の複合振動を起こさせるようにしたので、以下のような効果が得られる。
（イ）小形、薄形、軽量に設計することができ、製造容易で安価である。
（ロ）使用条件によつて寸法等を任意に選べるので、弾力性のある設計が可能である。
（ハ）駆動電圧が低く、電源が簡単である。
（ニ）スライダが駆動子に常に圧接しているので、パツクラツシユがなく、即動、即停止ができる。
【図面の簡単な説明】
第1図～第5図はこの発明の一実施例を示し、第1図は平面図、第2図は側面図、第3図は動作説明線図、第4図および第5図はそれぞれ応用例の平面図である。第6図～第8図は他の実施例を示し、第6図は平面図、第7図は側面図、第8図は動作説明線図である。第9図は従来の圧電共振モータの平面図、第10図は同じく側面図である。
1, 9……基体、2a, 2b, 2c, 11a, 11b, 11c……圧電素子、3a, 3b, 10a, 10b……駆動子、U₁, U₂……共振ユニット。

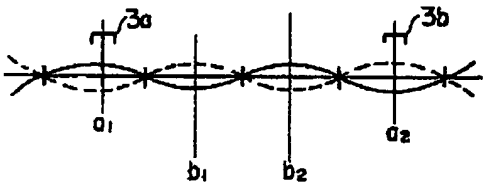
【第1図】



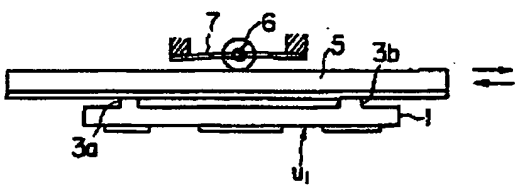
【第2図】



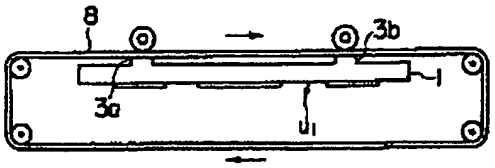
【第3図】



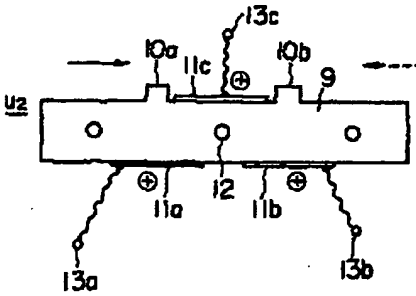
【第4図】



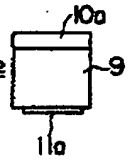
【第5図】



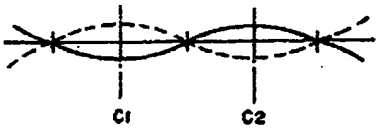
【第6図】



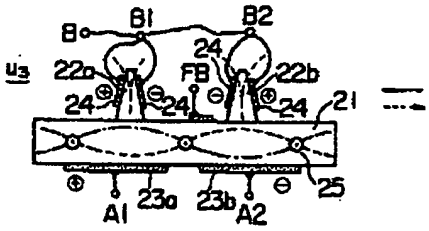
【第7図】



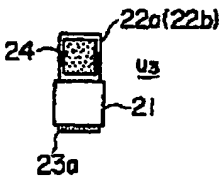
【第8図】



【第9図】



【第10図】



【公報種別】特許法（平成6年法律第116号による改正前。）第17条の3の規定による補正
【部門区分】第7部門第4区分
【発行日】平成11年（1999）6月14日

【公告番号】特公平6－106028
【公告日】平成6年（1994）12月21日
【年通号数】特許公報6－2651
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【特許番号】2137057
【国際特許分類第6版】
H02N 2/00 C

【手続補正書】
1 「特許請求の範囲」の項を「1 角棒状の弾性体でなる基体と、この基体の一側面所定位置に一体に突設された複数個の駆動子と、前記基体に接合され交番電圧が加えられて前記基体に高調波の屈曲共振振動と長さ方向共振振動とを同時に発生させる複数個の圧電素子とを備えた共振ユニットからなり、前記駆動子は、前記基体の屈曲共振時の腹上中央部の振動方向側に位置しており、分極極性を選択配列した圧電素子に加える電圧の切換手段を備え、圧電素子の一部および別個に設けたフィードバック端子のいずれかからの信号を位相調整して自励回路を形成し、安定的駆動のためフィードバック端子からトリガー電圧を印加するようにした圧電共振モータ。」と補正する。
2 「発明の詳細の説明」の項を「本発明は、圧電共振モータに関し、特に、小型軽量で高精度の直線駆動の位置決め制御が容易な圧電共振モータに関する。
第9図、第10図は、本出願人が先に出願した（実願昭61－161013号）従来のこの種の圧電共振モータであり、図において、弾性体でなり、角棒状の基体21の一側面に、二つの駆動子22a、22bが突設されている。駆動子22a、22bは基体21の振動の腹の位置に当たる。基体21には屈曲モード用の二つの圧電素子23a、23bが、駆動子22a、22bの各面には第2の圧電素子24が貼着されている。
このように構成された共振ユニットU₁は、節の位置に形成された取付穴25により適宜に固定される。⊕、⊖は分極の極性であり、A_1、A_2、B_1、B_2およびBはそれぞれ接続リードの端子を示している。
以上の構成により、超音波領域の⊕電圧を端子A_1とBにに供給すると、基体21と駆動子22a、22bは点線のように屈曲し、駆動子22a、22bの先端に圧接されている被駆動体（図示せず）は駆動子22aにより実線矢印の方向へ蹴り出される。
端子A_1とBに⊖電圧を印加すると、共振ユニットU₁は破線のように屈曲し、今度は駆動子22bが被駆動体を実線矢印の方向へ蹴り出す。
以上の電圧印加を、端子A_2とBを対象にして行うと、端子A_1側とA_2側の分極が互いに逆であるため、動作が逆となり、被駆動体は破線矢印の方向へ駆動される。
以上のようにして被駆動体は、二つの互いに反対の方向へ任意に直線駆動される。
以上のような従来の圧電共振モータでは、基体のみならず駆動子にも、動作仕様に極性が合致するように、圧電素子を接合配置しないと所定の動作が得られないことから、製造作業が複雑で、また、駆動子の長さ（高さ）がある程度必要とするために、極薄のものが得られないという問題点があった。
この発明はかかる問題点を解消するためになされたもので、圧電素子の接合箇所を少なくして製造作業を簡略し、薄型で、かつ、低コストの圧電共振モータを得ることを目的とする。
本発明の構成は、角棒状の弾性体でなる基体と、この基体の一側面所定位置に一体に突設された複数個の駆動子と、前記基体に接合され交番電圧が加えられて前記基体に高調波の屈曲共振振動と長さ方向共振振動とを同時に発生させる複数個の圧電素子とを備えた共振ユニツトからなり、前記駆動子は、前記基体の屈曲共振時、の腹上中央部の振動方向側に位置しており、分極極性を選択配列した圧電素子に加える電圧の切換手段を備え、圧電素子の一部および別個に設けたフィードバック端子のいずれかからの信号を位相調整して自励回路を形成し、安定的駆動のため、フィードバック端子からトリガー電圧を印加するようにした圧電共振モータである。
本発明において作用を述べると、本発明においては、基体に屈曲振動を起こさせる圧電素子と長さ共振を起こさせる圧電素子とに、並列に共振周波数の交番電気信号を印加すると、共振ユニツトは屈曲モードと長さモードの両方のモードで同時に振動して複合共振するので、駆動子の自由端は所定の方向に振動する。
次に、実施例1について述べると第1図乃至第5図は、この発明の一実施例を示し、第1図と第2図において、角棒状の弾性体でなる基体1の下面に、圧電効果d_{31}の圧電素子2a、2bおよび2cが貼着されている。基体1の上面に、一体に突出形成された駆動子3a、3b

は、基体1の屈曲共振動作時の腹部中央に位置して共振ユニットU₁を形成する。

基体1と駆動子3a、3bを一体化した弾性体は、ガラス状カーボン材や繊維強化金属FRMなど、振動損失が少なくて、耐摩耗性に富み、かつ、熱膨張係数が圧電素子と同じ、2．5×10^{-6}／摂氏度程度に小さい材料が適している。第3図は、第1図と第2図に示す共振ユニットU₁の高調波（第3上音）共振姿態を示し、節部を5箇所に、腹部を4箇所a_1，a_2，b_1，b_2に形成されるようにし、中心非対称形になっている。駆動子3a、3bはそれぞれ中心より外側の腹部a_1，a_2の位置に設けられている。

以上の構成になる共振ユニツトU₁の動作を詳細に見ると、まず、端子4a、4cから圧電素子2a、2cに交番信号を互いに並列に印加すると、共振ユニツトU₁は、圧電素子2aにより高調波（第3上音）の屈曲振動を起こし、同時に圧電素子2cによつて角棒状弾性体の長手方向基音共振を起こして複合振動を行う。

長さ方向の基音周波数で発生した振動の節は中心部の一点にあらわれ、角棒の両端部はそれぞれ変位最大になる。

いま、駆動子3a、3bの位置が基体1の両端部寄りの腹の位置にあるため、駆動子3a、3bの先端上面の挙動は、交互に上下運動を行ないながら、それと併行して基体1の長手方向にも振動することになる。そのため、第4図に示すように、スライダ5を、プラスチック製のボールベアリングなどのコロ6およびバイアス用のバネ手段7により、駆動子3a、3bの先端に圧接しておくと、両者の接触部分の摩擦により、スライダ5は、第1図の分極配置では、実線矢印の方向に移動される。また、圧電素子2cと2bへの並列給電では、スライダ5は、破線矢印の方向へ移動する。このように電圧印加を切り換えることにより、スライダ5の移動方向を任意に制御することができる。また、スライダ5の駆動子との接触面側にはブチルゴム系のコーテイングを施し、スライダ5の移動を円滑にしている。スライダ5の代りにキャッシュカードなどを移動させる時は、駆動子3a、3bの先端部に、たとえば、ブチルゴム系の混合材を塗布すると、スリップ動作が少なくなる。この塗布材は、カードの材料に合わせて、もつとも効率のよいものに選択すればよい。

第5図は、共振ユニツトU₁の駆動子3a、3bにエンドレスベルト8を圧接してエンドレスベルト8を任意の方向に回転制御する場合を示している。

なお、第1図、第2図においては、駆動子3a、3bの位置が基体1の両端部の腹の位置である場合を示したが、駆動子を第3図で中心寄りの腹b_1、b_2の位置としてもよく、同様の効果が得られる。この場合は速度よりも高負荷駆動の用途に供して、より有効である。

また、第1図における圧電素子2cは、基体1の上、下面に接合配置してもよく、その一部を切離して、フィードバック端子として自励発振用に仕様する。フィードバック信号を圧電素子2a、2bの両方から取出し、これを並列接続に使用すると、第3上音以外の信号の混入が防止出来るので安定した発振を行うのに効果的である。

次に上記実施例の具体的数値例を挙げる。

基体：長さ107．8㎜×厚さ6．0㎜×幅15．0㎜

基体の材質：硬質アルミニウム

駆動子：高さ2．0㎜×幅3．5㎜

駆動子の位置：基体両端より20㎜

圧電素子：屈曲用　長さ15㎜×幅12㎜×厚さ0．6㎜

長さ用　長さ30㎜××幅12㎜×厚さ0．6㎜

共振ユニツトU₁の厚さ：0．6＋6＋2＝8．6㎜

駆動周波数：23．07KHz

入力電圧：6v（r.m.s）

スライダ材質：フエノール樹脂3㎜厚

スライダ接触面：バインダ入りブチルゴム1㎜厚

相対的移動力：150グラム

移動スピード：230㎜／秒

なお、以上の実験効果は一般材料を用いた場合であり、使用目的により、材料をさらに吟味すれば、より目的にあった値が得られることは当然予想される。第6図乃至第8図は、他の実施例を示し、共振ユニツトU₂は、角棒状の基体9の下面に圧電素子11a，11bを貼着し、基体9の上面には中央部に圧電素子11cを貼着するとともに駆動子10a，10bを突設してなるもので、駆動子10a，10bは第8図に示す振動の腹の位置C_1，C_2にある。12は取付穴で、屈曲と長さ双方の振動の節の位置にある。

この実施例は、基体9は、屈曲モードを高調波（第1上音）で、長さモードを基音でそれぞれ共振するものである。

いま、端子13a，13cから圧電素子11a，11cに共振周波数の電圧を印加すると、圧電素子11aにより、第8図に示すような第1上音モードが発生する。同時に、圧電素子11cによって長さモードの共振を起こして複合振動が発生する。これにより、第6図に示す分極方向の場合、駆動子10a，10bに圧接されているスライダ（図示せず）は、実線矢印の方向へ移動する。同様にして圧電素子11b，11cに切り換えて並列給電すれば、スライダは、破線矢印の方向へ移動する。

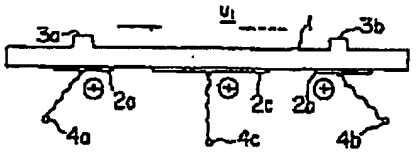
次に効果を述べると、この発明は、以上の説明から明らかなように、圧電素子が接合されて屈曲振動、伸縮振動を同時に発生する基体に駆動子を一体に突設し、駆動子先端に所定方向の複合振動を起こさせるようにしたので、以下のような効果が得られる。

（イ）　小形、薄形、軽量に設計することができ、製造容易で安価である。

（ロ）　使用条件によって寸法などを任意に選べるの

で、弾力性のある設計が可能ある。
（ハ）　駆動電圧が低く、電源が簡単である。
（ニ）　スライダが駆動子に常に圧接しているので、バックラッシュがなく、即動、即停止が出来る。」と補正する。
3　「図面の簡単な説明」の項を「第1図はこの発明の一実施例の平面図であり、第2図はこの発明の一実施例の側面図であり、第3図はこの発明の一実施例の動作説明線図であり、第4図はこの発明の一実施例の応用例の平面図であり、第5図はこの発明の一実施例の応用例の平面図であり、第6図はこの発明の他の実施例の平面図であり、第7図はこの発明の他の実施例の側面図であり、第8図はこの発明の他の実施例の動作説明線図であり、第9図は従来の圧電共振モータの平面図であり、第10図は、従来の圧電共振モータの側面図である。　＊1……基体　2a，2c，2b……圧電素子
3a、3b……駆動子　4a、4c……端子
5……スライダ　6……ボールベアリングなどのコロ
7……バネ手段　8……エンドレスベルト
9……基体　10a、10b……駆動子
11a、11c、11b……圧電素子　U_1、U_2……共振ユニット
22a、22b……駆動子　23a、23b……圧電素子
12……取付穴」と補正する。
4　図面全図を「

第1図



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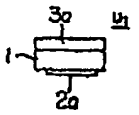
第2図



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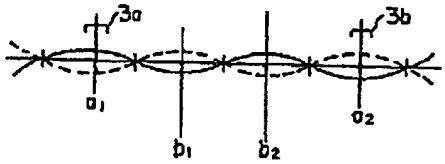
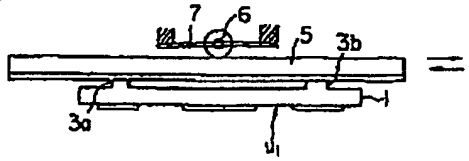
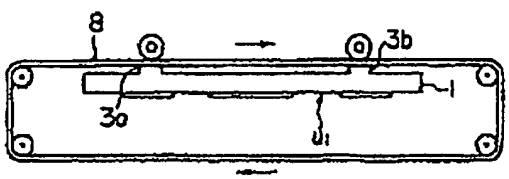
第3図



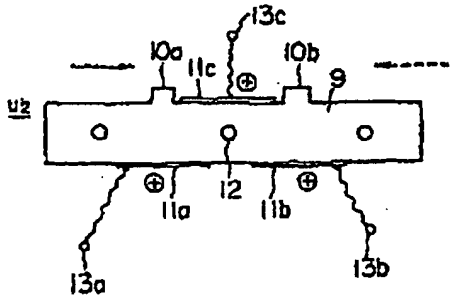
第4図



第5図



第6図



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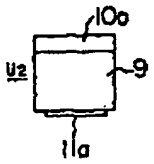
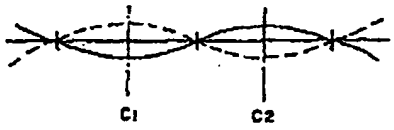
第7図



第8図



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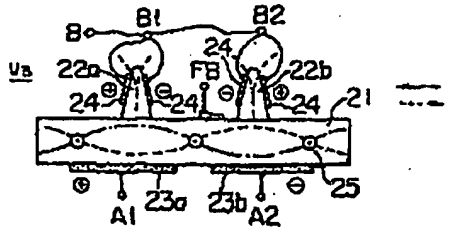
第9図



」と補正する。

第10図